**PARATRANSIT: SHAPING THE FLEXIBLE TRANSPORT FUTURE**

**CHAPTER 1**

**INTRODUCTION**

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**ABSTRACT**

**Purpose**

This chapter provides the context and highlights how the different chapters contribute to a greater understanding of how the flexible transport future may emerge. It synthesises the issues and highlights the debates which are central to the chapters.

**Methodology/Approach**

This chapter reviews the content of the book, drawing together the threads to provide insights as to the important issues and policies around the world both in practice and for the future.

**Findings**

This book has benefited significantly from the papers presented at the TRB-sponsored International Paratransit Conference, “Shaping the New Future of Paratransit”, held in Monterey, CA in the United States (US) in October 2014. Over and above this, chapters were commissioned especially so as to provide a broad understanding of context and operations and how these come together in the context specific case studies. The present is affected by the common problem of the silo nature of funding for transport and the need for innovative solutions to develop partnership working and business models which will allow paratransit or flexible transport systems (FTS) to flourish. This chapter also points to the considerable contribution of the chapters which look to the flexible transport future. These detail the way in which our understanding of mobility must change, the role of technology as an enabler and the way in which automation will change each mobility mode and the connections between them.

**Originality/Value**

This chapter offers a multi-dimensional perspective of the content of this book which examines the current status, operational aspects and a wealth of case study material to underpin policy and practice in paratransit or FTS. Its particular value is centred on providing not only practice-focussed policy content but research content which postulates how the flexible future may need to be influenced to emerge in a way to add to sustainability.

**Keywords:** Paratransit, flexible transport systems (FTS); demand responsive transport (DRT), mobility, policy and planning

**INTRODUCTION**

The decades of the 1970’s and 1980’s witnessed both substantial conceptual and practical interest in paratransit across Europe and North America, as well as widespread implementation of paratransit services and strategies. This has subsequently waned, to the point where paratransit (more often referred to as flexible transport systems (FTS), particularly in Europe) is frequently relegated to the very narrow niche of special needs within the spectrum of collective transport services.

However, recent technological advances have made feasible new and/or improved approaches for organizing and delivering local passenger transportation and the delivery of more flexible transport to more than simply disability or older clients. This means that paratransit or FTS is capable of playing a part in the development of sustainable options for the future. This is being demonstrated in some parts of the world and research in this area is necessarily affected by these developments. It is increasingly clear that a new set of possibilities is emerging although at different speeds in different places.

This book brings together a collection of papers representing the state-of-the art in flexible transport systems. Its draws strongly on the TRB-sponsored International Paratransit Conference, “Shaping the New Future of Paratransit”, held in Monterey, CA in the United States (US) in October 2014 as well as selected additional contributions from experts in the field. The Monterey conference drew a worldwide attendance from a cross-section of operators, technology providers, policymakers and researchers and was notable in that it represented the first coming together of the international paratransit community in conference format since 1997. The purpose of this book is to update previous contributions in the field (e.g. Kirby et al, 1974; Ambrosino et. 2004; Nelson and Wright, 2012) through analysis of the key issues relevant to flexible transport systems at this time and to highlight key points and common strands of worldwide experience to provide a coherent statement of current practice and research as well as pointers to the future.

There have been significant developments over that last 15 years. From a European perspective the development and large scale adaption of FTS is characterized by the growth of open and integrated Demand Responsive Transport (DRT) - a theme which is explored by Westerlund in Chapter 4. Small and medium sized applications are also of interest since this is where most of the trips are being taken, often in the voluntary and informal sectors. Whilst DRT seems to have made considerable progress, it is still seen as less attractive by large public transport organizations since trip volumes are typically low compared to main-stream public transport, unless deliberate action is taken to exploit economies of scale. This has occurred successfully in some parts of the world with general public services being offered in Denever, USA and the development of the Flextur services in Denmark which achieve five million trips per annum over the whole of the country.

Whilst FTS in the form of DRT has matured in the last 15 years while remaining in many respects a niche form of shared transportation, there are some exciting developments. The movement from government funded services to services provided by private companies such as Transport Network Companies (TNCs) – discussed in Chapter 18, is an interesting development which needs a considered response from the public authorities.

Paratransit or FTS services deliver mobility. Mobility drives our lives in many ways and we need to understand these processes to be able to predict how new technologies in services and products will become absorbed or be rejected in the future, and by whom. Mobility is a world-wide, mega industry with all societies showing a thirst for more and more of it. Mobility is more than just moving around and is used to define social status (what type of mobility you have), social interactions and social inclusion but also has a potentially negative impact on sustainability and climate change. Understanding the variety of factors that affect the demand side of paratransit will lead to better appreciation about how people might respond to the offerings of paratransit and FTS in the future. Demographic change, evolving travel attitudes and choices, new technological innovations, consumer preference for ageing in community and the effects of past development patterns will profoundly influence the future of paratransit. These changes have the ability to expand the potential for paratransit, particularly as technological advances have transformed the potential for flexible transport systems to address the demands of all age groups more effectively than in the past; indeed as Teal argues in Chapter 16 technology is changing the market feasibility of the DRT product.

The book is structured into four sections. It begins with a set of contributions which reflect the changing *contexts* in which paratransit and flexible transport systems are delivered. The second section is concerned with *operational aspects* and the third section with *case studies.* The final section is concerned with looking to the *future* for new forms of paratransit / FTS and evolving forms of on-demand transport.

The context section begins with Chapter 2 in which Enoch and Potter discuss the role of regulatory and institutional structures in influencing the adoption of paratransit. They note that existing public transport modes are ill-suited to modern patterns of travel demand and argue that a system involving paratransit could produce enhanced social mobility and system level improvements in CO2 emissions. The chapter identifies the key issues raised by the emergence of new paratransit modes (e.g. Uber) and the new actors involved. A new regulatory structure is proposed that reflects this understanding.

The intersection of healthcare and transport has been a traditional stronghold of paratransit services, particularly in North America where paratransit is established as a key facilitator of access to healthcare for some population groups. Recent years have produced the most sweeping restructuring in history of how healthcare is provided in the US. More medical care is now provided on an outpatient basis than ever before. Legislative changes, most notably the Affordable Care Act, have likewise reshaped how healthcare is administered and paid for. These seismic shifts impact how community and public transport provides access to doctor’s offices, regional medical facilities and other treatment facilities. Non-emergency medical transport (NEMT) is to outpatient care as ambulances are to emergency rooms – a fundamental element in the continuum of care with paratransitemerging as a key facilitator of access to health care for some population groups. In Chapter 3 Macia describes how transportation brokers operate NEMT programmes in order to help control costs and improve quality. Opportunities occur through the partnership of public transport agencies and NEMT brokers working together to create efficiencies through data sharing, using data to develop and modify routes, adopting NEMT ridership to lower costs and promoting efficient use of vehicles by filling more seats and promoting prudent stewardship of taxpayer funding. Brokered models utilize networks of sub-contracted transportation providers.

Westerlund (Chapter 4) discusses the global trends in the development of large scale DRT describing recent experiences with the 30 largest DRT systems in the world which are defined as agencies providing more than one million passenger trips / year. This chapter shows the key trend is a movement away from large-scale schemes that are focussed only on special needs transportation to those which are “open” and may be found in urban, suburban and rural environments. Westerlund identifies little strategic focus for the development of open and integrated DRT in most of the large public transport authorities around the world, where DRT passenger volumes are marginal compared to mainstream public transport. Westerlund argues there is a need for international standardisation, particularly of ICT system architecture and interfaces but also for business models which allows a transparent comparison of system performance and cost efficiency.

Turning to operational aspects, there have been a number of significant ways in which paratransit services have evolved. In Chapter 5 Schiefelbusch discusses paratransit in Germany which since the 1980s has complemented conventional public transport in areas and times of low demand. Paratransit is operated by taxi and private sector companies as sub-contractors to public transport providers. This chapter describes the way in which volunteers play an increasingly important role through Burgerbus – where “citizens drive citizens”. Burgerbus represents voluntary engagement with the local public transport sector, involving use of small buses and is reliant upon local organization. Volunteering extends to the use of private cars, for persons needing personal assistance, such as escorts. This chapter demonstrates how the Bürgerbus service is more important than the provision of simply a mobility service with benefits extending to whole communities in terms of social cohesion. But the success depends on an understanding of volunteer motivation and this is crucial to transferability.

 One of the strengths of FTS is its ability to be deployed in a way which maximises the use of a scarce transport resource. In Chapter 6 Emele et al address the context of rural transport planning noting that where resources are fewer, effective co-ordination is required to provide passengers with efficient transport services. They present a novel visualisation tool, known as Flexible Integrated Transport Services (FITS), that transport commissioners, providers and administrators could employ to specify and edit the operating constraints as they redesign transport services. Results from the case study show how the effects of such constraint relaxation could be quantified in terms of changes in costs incurred by transport providers, the level of potential demand that could be covered and the associated revenues (fares and subsidies) which could be generated by providers. An understanding of the principles of cost-allocation is important when choosing the most appropriate contracting and service management approach. This theme is continued by Yaffe (Chapter 7) who describes how accurate cost reporting provides the foundation necessary to ensure an equitable and accurate distribution of costs among all participating agencies. This requires appreciation of the factors affecting cost allocation and resource assignment; cost drivers (understanding how customer priorities can affect costs); and activity drivers (understanding how system procedures can affect costs). Whilst Yaffe presents a process approach, Mulley and Clifton (Chapter 8) argue that the importance of appropriate decision making when planning flexible transport services is a universal issue with little current understanding of service costing and viability. The crucial element of this chapter is the understanding of the ‘golden rule’ and a distinction between understanding costs to make good decisions where the identification of avoidable costs is key and the accounting basis of cost allocation or the economic distinction between fixed and variable costs.

There is significant global variation in the institutional factors which impact on the delivery of accessible transport via DRT. The contribution by Wilson in Chapter 9 shows how an international perspective on policies and approaches to deliver accessible transportation can be valuable. In Europe, there are national foci on making regular public transport more accessible. Definitions of persons with restricted mobility vary widely as do approaches towards enhancing the paratransit service model (e.g. use of taxis, number of senior rides permitted etc.). Drawing on examples from France, Spain and California the findings show how the strengths of the “Persons with Reduced Mobility” (PRM) approach in Europe, where the national focus is on making regular transit more accessible and maximizing transit use rather than special services, could be transferable to California.

Significant technology advances have characterised the paratransit sector over the last 15 years, As technology becomes more integral to the future evolution of DRT systems, particularly those using Mobility Management concepts involving multiple organizations and their (often different) software applications in a common scheme for providing transportation services, the issue of what is included in the core technology infrastructure becomes increasingly important. ICT technologies are making it possible to implement innovative services that can improve the cost-effectiveness of DRT systems and reinforce DRT’s contribution to social inclusion. The role of ICT, including recent enhancements (from open data and cloud solutions to the mobile connections and social media) offers much for existing DRT architecture and schemes. In Chapter 10, Ambrosino et al introduce the concept of the Shared Mobility Services Agency for the planning and managing of collective transport services at urban and regional level. Building on previous work which established the concept of the Flexible Transport Service (FTS) Agency as a single co-ordination centre for different flexible services, this chapter extends the concept to consolidate the role of the Agency as a Shared Mobility Centre, including the integration of different on-demand or New Mobility Services and the co-ordination of different key actors in a co-modal approach.

The third section of the book turns to a series of case studies which present the diversity and vibrancy of the paratransit and FTS sector. This section opens with an unusual case study – that of FTS in a developing country context. In developing countries the need for accessible transport has led to multiple paratransit types based on flexibility and creative entrepreneurship. Eighty percent of the world’s disabled persons live in Asia, Latin America and Africa where 90% of children with disabilities do not go to school and 80 - 90% of working age adults with disabilities are not employed. Paratransit responses include moto-taxis in Mexico, auto-rickshaws in Nigeria and Tanzania; three-wheelers in Ho Chi Minh City; and special prototypes in Ecuador, Peru, Columbia and Mexico. Most of Latin America’s moto-taxis have room for a folded wheelchair. Pedicabs and ciclo-taxis are other modes while non-motorized vehicles include India’s EcoCabs. Bruun and Behrens describe a study of jitneys were studied in three congested cities in Africa: Cape Town, Dar es Salaam and Nairobi (Chapter 11). The paratransit mode share of total transit use in these cities is 45%, 98% and 87%, respectively. Understanding current conditions and analysing strategies to reform business models, operation practices and environment, the fleet, public institutions and governance could improve the potential for economic development as well as address congestion.

The UK has long been an incubator for innovative applications of flexible and demand responsive forms of transport, In Chapter 12 Connor charts the progression of DRT from its traditional niche market of special needs transport to its position as an integral component of a “total transport” system. This chapter tries to explain why the potential of FTS which appeared so evident prior to the Millennium failed to materialise. A complementary contribution by White (Chapter 15) explores the role of “conventional” and demand responsive bus services with reference to UK experience. In particular this chapter looks at how the provision of service may be delivered by fixed and FTS services and what trigger points might effectively point to one or the other type of provision being superior. White concludes that it is not straightforward and whether or not a particular paratransit or FTS service might be viable is context specific. In particular, exogenous factors such as population density and car ownership and the quality of service that may be provided by an existing fixed-route operator are important for assessing the base level for ridership against which other options need to be compared.

As noted in Chapter 5 the Community Transport sector has long been an important contributor to the flexible transport offer (see also Mulley and Nelson, 2012). Community Transport in Australia is the subject of Chapter 13 by Stevens and Denmark. The final case study comes from northern Europe where in Chapter 14 where Leiren and Skolloerud discuss how DRT services have been introduced in rural and depopulated areas of Norway. Here different models were implemented and the chapter discusses the costs and benefits or the different models in somewhat qualitative terms. It is clear that the more costly services can actually deliver more benefits to the community they serve but whether or not it is practical depends on the governance of the sector and availability of funds which are increasingly in short supply.

The final section of the book identifies some of key trends that are likely to influence the future of paratransit and flexible transport systems. The role of technology as an enabler for innovative service concepts represents one of the most significant developments of the last 15 years. Yet, knowledge of past DRT experiences (especially in Europe and US) shows that technology is often used for simplifying the complexity of the problems and tends to be considered as the overall solution. Therefore it is important to analyze and define not only the contribution that ICT can provide to DRT service management, but also to identify the support conditions for successfully implementing the appropriate ICT tools.

The new generation of ICT tools allow the development of an advanced cloud and modularity architecture with the objective to co-ordinate the main functionalities (ride management, booking, planning and dispatch) and decentralize the related control at local level (by web services, API and user devices, etc.). This is taken up by Teal in Chapter 16 where it is described how advances in mobile communications and computing may enable new forms of on-demand transportation that make the original vision for paratransit of the 1970s feasible. Technology can shift the supply curve for on-demand services, enabling a higher level of service for a given generalized cost (or a lower cost to provide a given customer utility), shifting the supply-demand equilibrium to a higher demand level. Potential applications to public demand-responsive service include: assembling supply from multiple providers, dynamic service configuration, more seamless service booking and customer information, better scheduling, assembling a critical mass of travellers for niche markets, and use of data for improvements to service. Obstacles remain to achieving high enough demand densities for truly viable public services, but there are promising developments that give reason for optimism. Atasoy et al report progress with simulations in research which can help identify outcomes or solutions which cannot be trialled in real life (Chapter 17). Their research uses a simulation of a DRT service that would allow travellers to choose among three modes, including minibus, taxi, and shared taxi and which dynamically optimizes the choices provided to travellers based on a mix of operator profit and consumer surplus. The simulation shows how economic welfare can be increased with little impact on profit. A test of the concept is planned for the Hino City district of Tokyo, on which the simulation is based.

Successful applications of new technology have been demonstrated by Transport Network Companies (TNCs) such as UberX and Lyft and in dynamic carsharing (e.g. Car2Go) and there is currently wide-ranging debate surrounding the extent to which they can be usefully implemented to improve the cost effectiveness and reach of DRT or FTS services more generally.Interest surrounds whether TNCs and carsharing have any environmental benefits, and whether the theoretical demand-responsive productivities that higher demand densities should enable will prove actually achievable in practice and how TNCs can be part of publically provided services, especially for those passengers with disabilities or without a smart phone. The most successful “new” services to date are private ones that do not provide public, shared-ride service, but they may be useful to some customers of existing specialized paratransit services. This is explored in some detail by Koffman in Chapter 18 where the idea that TNCs are seen as threatening current paratransit business models and services by their offer of innovative opportunities to meet demand is explored. In some cities, TNCs are taking market share and attracting drivers from the taxi industry, reducing taxi capabilities to provide paratransit rides. As TNCs rely on smartphone technology, a large proportion of paratransit users are not yet able to access their services. Agencies sponsoring paratransit services also are concerned about TNC potential liability issues including insurance coverage and oversight of vehicle mechanical condition and accessibility, driver suitability and training, potential for discrimination, and rates.

Finally, in Chapter 19 Kent and Dowling focus on an alternative to conventional car ownership to describe how car sharing can be promoted as a more sustainable form of transport. This is really looking to quite a different future for the traditional users of paratransit or FTS users. It is clear that the mobility horizons of the future – from 2020 onwards – will have very important impacts on the way in which our cities retain or develop sustainability. Considering the new economic models that are emerging for cars on demand suggests that they may not contribute to a more sustainable future, especially if the ownership paradigm does not change. Whilst it may seem that cars on demand can lead to a decrease in the vehicle miles travelled and lead to greater inclusion because of the absence of a need for one to one ownership, these benefits are open to erosion unless ‘ownership’ develops a new meaning.

**CONCLUSIONS**

The papers presented at the TRB-sponsored International Paratransit Conference, “Shaping the New Future of Paratransit”, held in Monterey, CA in the United States (US) in October 2014 and the chapters additionally commissioned for this book show that the international paratransit community is in good shape. As our understanding of mobility changes so paratransit, with its ability to address changing demand-side factors through applying a mix of effective technology, informed policy-level decision-making, flexibility in planning and response to local needs, can become part of the overall mobility offerings. Technology is a key enabler, but no more than that and the community must learn to understand technologies role in generating different transport futures, including customised solutions tailored to the needs of different market segments.

The future is increasingly going to be affected by increasing automation in all mobility modes. It is no longer a question of if automation can occur but when. The presence of automation will bring increasing flexibility to all the mobility services on offer and will lead to tailored, seamless and reliable services with the opportunity to make a difference by including all elements of communities. At this stage it is still an open question as to whether future generations will grasp and find use for this expanded and tailored mobility offer – will the different modes be flexibly used to provide essential services so that paratransit options increase to provide the mobility of choice or will paratransit or FTS decide the fight for market share is not worth the effort in which case the best outcome is to serve only the mobility needs of the disadvantaged?

A common problem between most jurisdictions is the silo nature of funding for transport and innovative solutions are required to develop partnership working and business models that will allow paratransit to flourish. This will be key to success or failure in the future. However, it must not be forgotten that transport solutions exist to serve users. Users play a key role in this sector and user-led solutions are a key factor in successful paratransit solutions. As producers as well as consumers of data, users contribute to the overall transit information ecosystem. Barriers to implementation remain a concern and whilst the industry may understand the barriers, the users do not necessarily know about them. Marketing of the product remains essential.

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